

Remarks

Applicants respectfully request that the foregoing amendments be made prior to examination of the present application. Applicants respectfully request entry of the above amendments in order to remove multiple dependencies and correct informalities. A first office action on the merits is awaited.

Please direct all correspondence to the undersigned attorney at the address indicated below.

Respectfully submitted,

Date: November 15, 2001

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE**  
**SPECIFICATION**

Page 1, the title should read:

**[ALUMINIUM] ALUMINUM ALLOY STRIP MANUFACTURING PROCESS FOR  
THE MANUFACTURE OF BRAZED HEAT EXCHANGERS**

Page 1, line 2, paragraph 1:

The invention relates to the manufacture of thin strips (of a thickness generally between 0.1 and 1.5 mm) made of aluminum-manganese alloy (3000 series according to the Aluminum Association designations), clad on one or two sides with an **[aluminium-silicon]** **aluminum-silicon** alloy (4000 series according to the Aluminum Association designations). Said strips are intended to manufacture heat exchanger deep drawn components assembled by brazing, said exchangers being used in particular in engine cooling and automobile body air conditioning systems, and more particularly for air conditioning unit evaporator plates. Brazing techniques for **[aluminium]** **aluminum** alloys are described for example in the article by J.C. Kucza, A. Uhry and J.C. Goussain "Le brasage fort de l'aluminium et ses alliages", published in Soudage et Techniques Connexes, Nov.-Dec. 1991, pp. 18-29. The strips according to the invention are used particularly in non-corrosive flux brazing techniques such as NOCOLOK® or CAB (controlled atmosphere brazing), but may also be used in other brazing techniques such as vacuum brazing.

Page 1, line 25, paragraph 2:

The use of **[aluminium]** **aluminum** alloys in automobile vehicle heat exchangers has developed in recent years, particularly due to the weight gain provided with reference to that of copper alloys. The properties required for the **[aluminium]** **aluminum** alloy strips used for the manufacture of brazed exchangers are particularly a good brazing capacity, a high mechanical resistance after brazing, such that the thinnest possible strips can be used, sufficient formability for easy shaping of the components, particularly evaporator plates comprising deep drawn ribs, and finally a good corrosion resistance. Said resistance is generally characterized by the SWAAT (salt water acetic acid test) test according to the standard ASTM G85. Naturally, it is

important for the elaboration cost of the strips to be compatible with automobile industry requirements.

Page 3, line 31, paragraph 8:

The corrosion resistance of the brazed exchangers, as measured by the SWAAT test, depends not only on the composition of the core alloy or the selected brazing alloy. The phenomenon which practically always seems to cause rapid corrosion of exchangers and particularly of evaporator plates is liquid film migration or LFM. This phenomenon is described, for example, in the article by H. S. Yang and R.A. Woods "Mechanisms of Liquid Film Migration (LFM) in Aluminum Brazing Sheet", VTMS3 Conference Proceedings, SAE International, Indianapolis, 1997, pp. 639-658. This consists of a diffusion process of the silicon from the brazing alloy to the core during brazing, the brazing alloy being either that clad on the core alloy strip or deposited on said strip by any other means, or obtained from the coating of the part adjacent to the brazing. This induces the formation of precipitate-rich grain boundaries, which form paths particularly liable to intergranular corrosion, due to the significant difference in potential between the phases present and the [aluminium] aluminum matrix. The presence of dislocations favours this phenomenon. This is one of the reasons, in addition to the improved formability, why an annealed temper is used, which results in a fine-grained recrystallized structure. However, for exchanger plates comprising deformed parts, shaping generates variable strain hardening in the part, and, to obtain a recrystallized microstructure throughout, it would be necessary to anneal the part after shaping, which would increase production costs. This is particularly the case for evaporator plates.

Page 11, after line 25, please insert the following paragraph:

**The priority document, French patent application number 0014791, filed November 16, 2000, is incorporated herein by reference in its entirety including the title, abstract, specification, claims, and figures.**

**VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE CLAIMS**

1. [Process] **A process** to manufacture a clad strip, < 1.5 mm thick, [intended for] **suitable for use in** the manufacture of brazed heat exchangers, comprising:
  - casting of a plate made of core alloy [composed as follows] **comprising** (% by weight):  
Si < 0.8 Fe < 0.8 Cu: 0.2 - 0.9 Mn: 0.7 - 1.5 Mg < 0.4 Zn < 0.2 Ti < 0.1 other elements < 0.05 each and < 0.15 in total, the remainder aluminum,
  - homogenization of said plate between 550 and 630°C for at least one hour,
  - cladding on one or two sides of said plate of a brazing aluminum alloy,
  - hot rolling followed by cold rolling of the plate to a thickness close to the final thickness,
  - recrystallization annealing of the strip between 300 and 400°C,
  - strain hardening of the annealed strip to obtain a permanent deformation between 2 and 100 and the final thickness.
2. [Process] **A process** according to claim 1, [characterized in that] **wherein** the core alloy contains less than 0.01% Cr, Zr, Hf, V or Sc.
3. [Process] **A process** according to [any of claims 1 or 2] **claim 1**, [characterized in that] **wherein** the brazing alloy [contains] **comprises** 5 to 13% silicon.
4. [Process] **A process** according to [any of claims 1 to 3] **claim 1**, [characterized in that] **wherein** the homogenization time is greater than 3 hours.
5. [Process] **A process** according to [any of claims 1 to 4] **claim 1**, [characterized in that] **wherein** the strain hardening of the annealed strip is performed with a permanent deformation between 4 and 80.

6. **[Process] A process** according to **[any of claims 1 to 5] claim 1**, **[characterized in that] wherein** the strain hardening of the 5 annealed strip is performed by skin-pass type rolling.

7. **[Process] A process** according to **[any of claims 1 to 5] claim 1**, **[characterized in that] wherein** the strain hardening of the annealed strip is performed by tension levelling.

8. **[Clad] A clad** strip manufactured using a process according to **[any of claims 1 to 7] claim 1**, **[characterized in that] wherein**, after shaping and brazing, **[it] said clad strip** shows a perforation-free service life in a SWAAT test according to ASTM G85 standard of over 40 days.

**VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE ABSTRACT**

Page 14, please delete the abstract in its entirety and insert new abstract:

The invention relates to a process to manufacture a clad strip, < 1.5 mm thick, intended for the manufacture of brazed heat exchangers, comprising:

- casting of a plate made of core alloy composed as follows (o by weight):

Si < 0.8 Fe < 0.8 Cu: 0.2 - 0.9 Mn: 0.7 - 1.5 Mg < 0.4 Zn < 0.2 Ti < 0.1 other elements < 0.05 each and < 0.15 in total, the remainder **[aluminium] aluminum**,

- homogenization of said plate between 550 and 630°C for at least one hour,

- cladding on one or two sides of said blank of a brazing **[aluminium] aluminum** alloy, preferentially containing 5 to 13% silicon,

- hot rolling followed by cold rolling of the plated blank to a thickness close to the final thickness,

- recrystallization annealing of the strip between 300 and 4000C,

- strain hardening of the annealed strip to obtain a permanent deformation between 2 and 10% and the final thickness.

**VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE ABSTRACT**

Page 14, please delete the abstract in its entirety and insert new abstract:

The invention relates to a process to manufacture a clad strip, < 1.5 mm thick, intended for the manufacture of brazed heat exchangers, comprising:

- casting of a plate made of core alloy composed as follows (o by weight):

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- homogenization of said plate between 550 and 630°C for at least one hour,

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- hot rolling followed by cold rolling of the plated blank to a thickness close to the final thickness,

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